Coeur d'Alene Basin Environmental Monitoring Program - Surface Water

Annual Data Summary – Water Year 2020

Photographs: South Fork Coeur d'Alene River at Elizabeth Park near Kellogg, Idaho, USGS site number 12413210. Photographs by Dan Hess, USGS.

Coeur d'Alene Basin Environmental Monitoring Program - Surface Water

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Overview

The United States Geological Survey (USGS) operates and maintains twelve real-time stream gaging sites and collects surface water-quality samples two to four times annually at twenty monitoring sites (Figure 1) in the Spokane and Coeur d'Alene River basins (Clark and Perreault, 2017). This work is conducted in cooperation with the United States Environmental Protection Agency (EPA) to support the Coeur d'Alene Basin Environmental Monitoring Program (BEMP) (U.S. Environmental Protection Agency, 2002; 2012).

The Coeur d'Alene River extends across Idaho from the Montana border on the east to the Washington border on the west. Streams within the basin have been extensively affected by historic mining activities and are subject to ongoing remedial actions. The Coeur d'Alene River basin is mountainous, with elevations ranging from 2,000 to 6,850 feet above sea level. About 70 percent of the annual precipitation falls as snow during the winter (October through April), and the highest streamflows and metal loads normally occur during spring runoff. However, warm winter Pacific storms can affect the area, bringing heavy rains and warm temperatures that can cause rapid snowmelt and produce high streamflow rain-on-snow events. These events can be associated with high transport of sediment and sediment-bound trace metals. In contrast, the lowest streamflows and highest dissolved metal concentrations typically occur during September and October (Clark and Mebane, 2014).

Selected streamflow and water-quality results from the water year 2020 surface water BEMP are presented herein. Additional water-quality and streamflow data are available in the USGS National Water Information System database, http://waterdata.usgs.gov/nwis (U.S. Geological Survey, 2021), and in the Excel workbooks provided with this summary.

Highlights from water year 2020 include the following:

- Streamflow gaging and water-quality sampling and analyses occurred at the normal intervals, with COVID-19 social distancing procedures in place, despite the challenges posed by the pandemic.
- Water year 20202 streamflows overall were similar to median conditions. Peak streamflows occurred during May and June and were similar in timing and magnitude to median peak streamflows.
- Comparisons between water year 2020 and 2010-2019 concentrations showed lower median total lead, dissolved zinc and dissolved cadmium concentrations in water year 2020 at most mining-affected sites.
- During water year 2020 and in conjunction the EPA Five-Year Review, the USGS published a report analyzing long-term trends in concentrations, loads and sources of select metals and nutrients in the Spokane River basin.

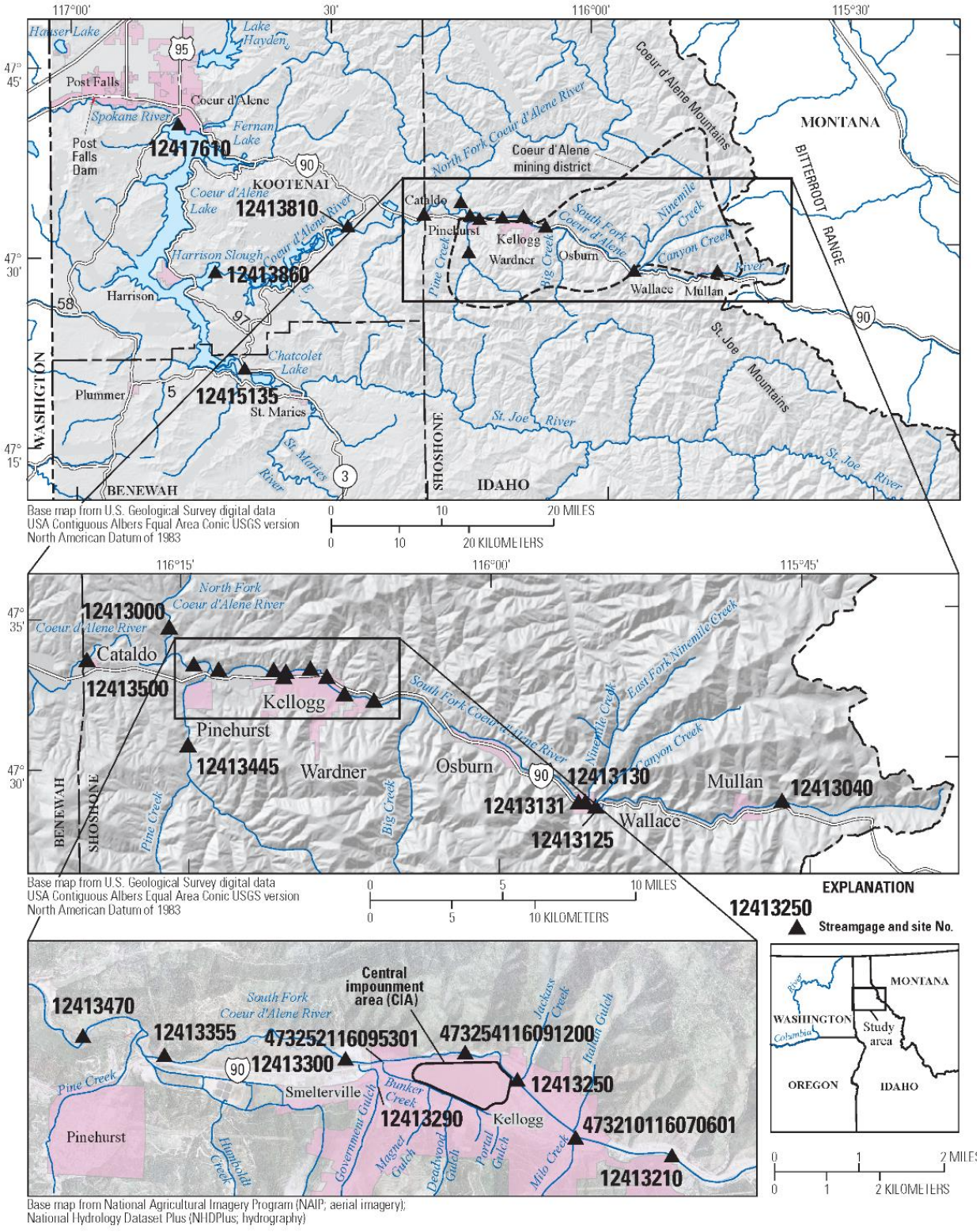

Figure 1. Sampling sites in the Coeur d'Alene and Spokane River Basins

Observations

Water year 2020 was characterized by streamflows that were generally similar to median conditions. Figure 2 shows median streamflow for the streamflow period of record and water year 2020 streamflow at continuously gaged sites in the basin. Winter storms caused only minor streamflow increases during the winter, and spring streamflows were lower than the median at each site. Spring snowmelt runoff began somewhat later than median runoff but the peaks were similar in magnitude and timing (May and June) to median runoff. Summer and fall baseflows throughout the basin were similar in magnitude and timing to median baseflows (Figure 2).

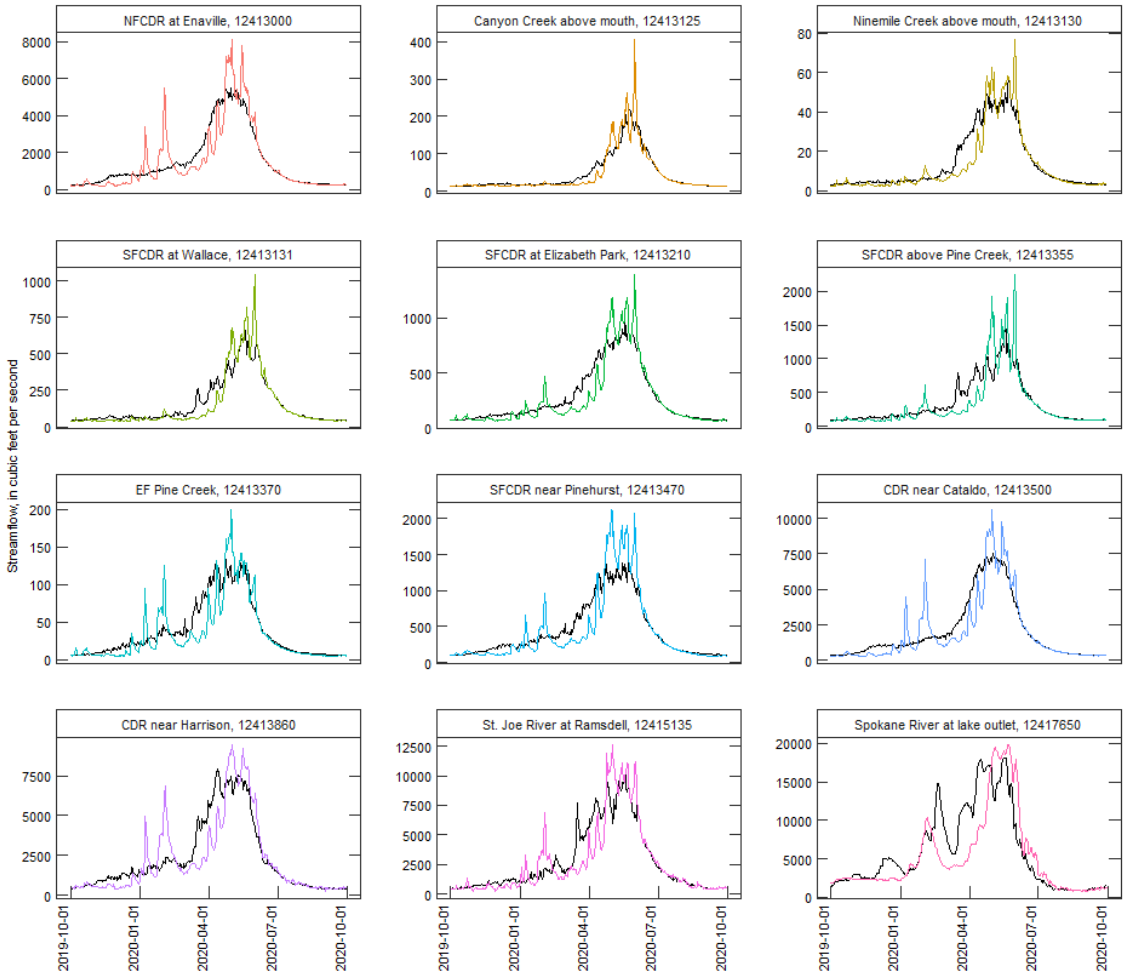

Figure 2. Water year 2020 streamflow at BEMP sites with continuous gaging. Colored lines show water year 2020 daily mean streamflow. Black lines show the median daily streamflow for the available streamflow period of record, which varies by site. NF, North Fork; SF, South Fork; CDR, Coeur d'Alene River. Note the vertical axis scale varies by plot.

Water-quality sampling events occurred during the rising limb of the spring snowmelt hydrograph in late April (due to the lack of winter storms), during peak streamflow conditions in late May, during the falling limb of the hydrograph in late June, and during baseflow conditions in late September. Water-quality sampling and analyses occurred at the normal intervals, with COVID-19 social distancing procedures in place, despite the challenges posed by the pandemic. However, due to a sample processing error, six

sites do not have sediment data (suspended sediment concentration and suspended sediment percent finer than 0.0625mm) for the April 2020 event.

Figures 3 through 5 show selected water year 2020 water-quality results (total lead, dissolved zinc and cadmium concentrations) visually compared to results from the previous ten years (2010-2019). Based on visual comparison, median total lead concentrations at most sites in water year 2020 were lower than or similar to 2010-2019 medians (Figure 3). At most sites, the range of 2020 concentrations was also narrower than in the preceding ten years. One site, the seeps north of tailings, had higher median concentrations in water year 2020 than during the previous ten years (Figure 3).

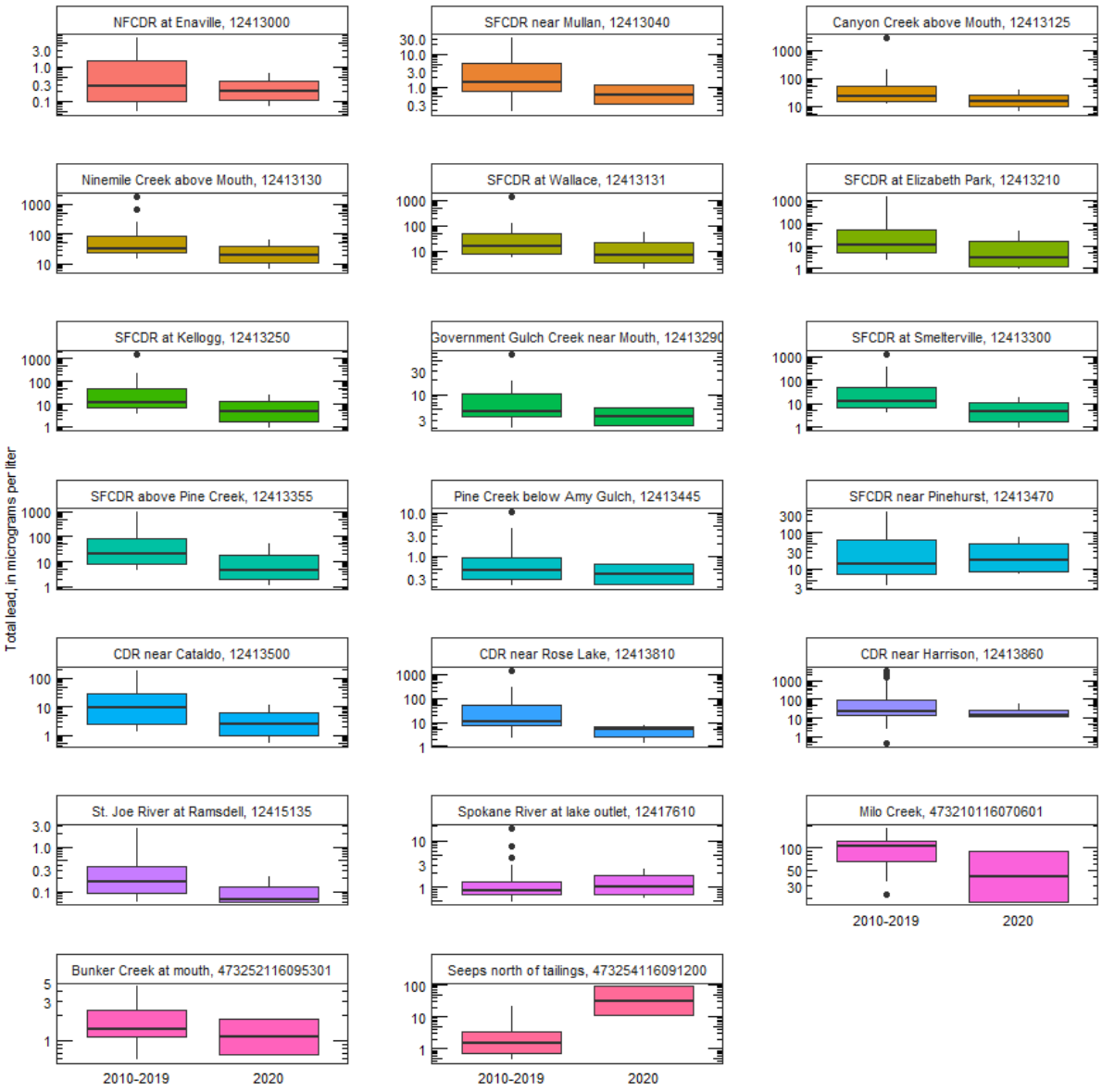

Figure 3. Total lead concentrations at BEMP sites in water year 2020 versus 2010-2019. Note the vertical axis scale is logarithmic and varies by plot. NF, North Fork; SF, South Fork; CDR, Coeur d'Alene River.

Based on visual comparison, median dissolved zinc concentrations at most sites in water year 2020 were lower than or similar to 2010-2019 medians (Figure 4). The range of measured concentrations for dissolved zinc was also narrower in water year 2020 than for 2010-2019 at most sites. However, in Bunker Creek, the median dissolved zinc concentration in water year 2020 was higher than in the previous ten years (Figure 4).

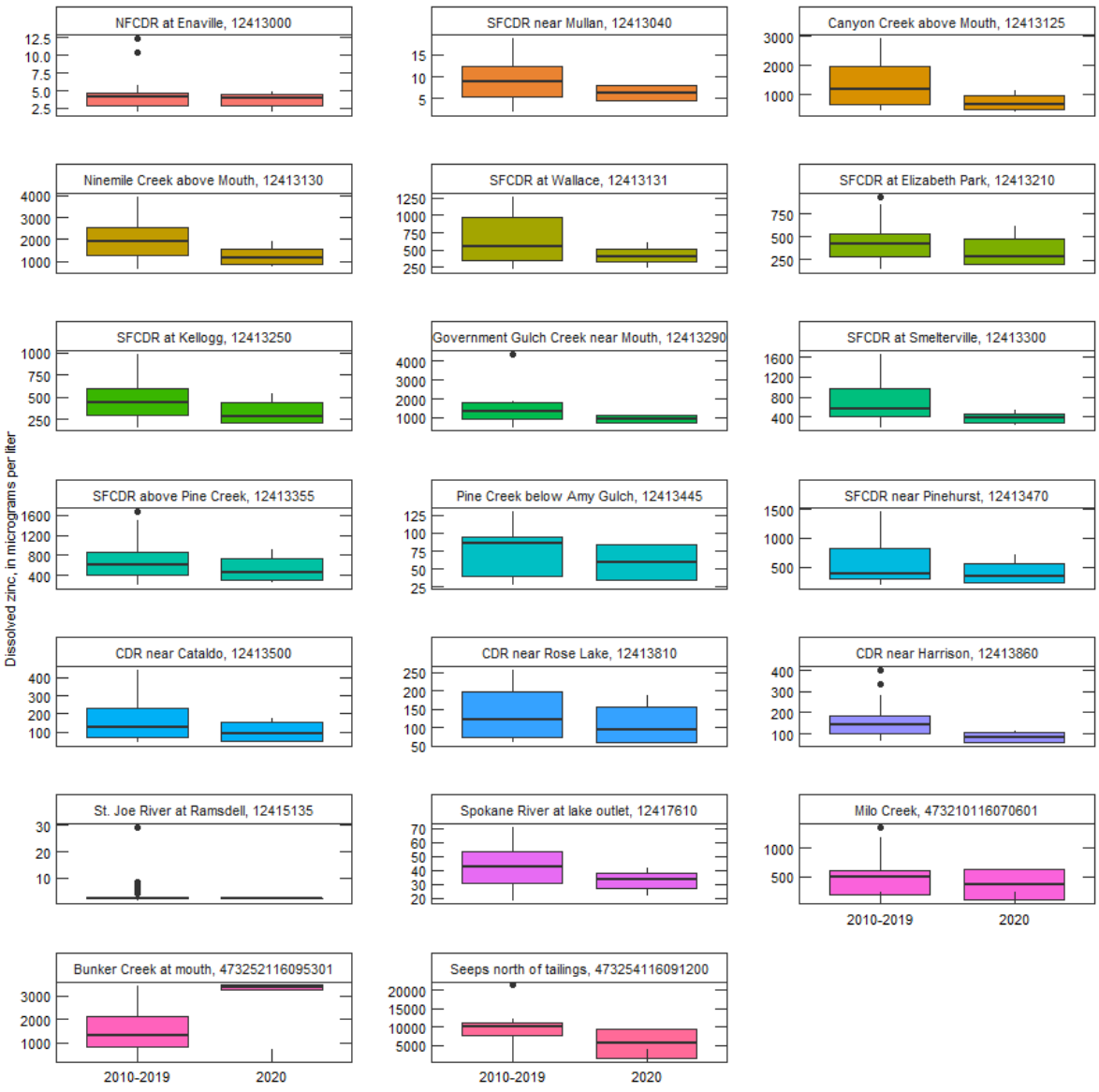

Figure 4. Dissolved zinc concentrations at BEMP sites in water year 2020 versus 2010-2019. Note the vertical axis scale varies by plot. NF, North Fork; SF, South Fork; CDR, Coeur d'Alene River.

Based on visual comparison, median dissolved cadmium concentrations at most sites in water year 2020 were lower than or similar to 2010-2019 median concentrations, and the range of concentrations were narrower (Figure 5). However, the range and median dissolved cadmium concentrations in Bunker Creek were higher in water year 2020 than in the preceding ten years (Figure 5).

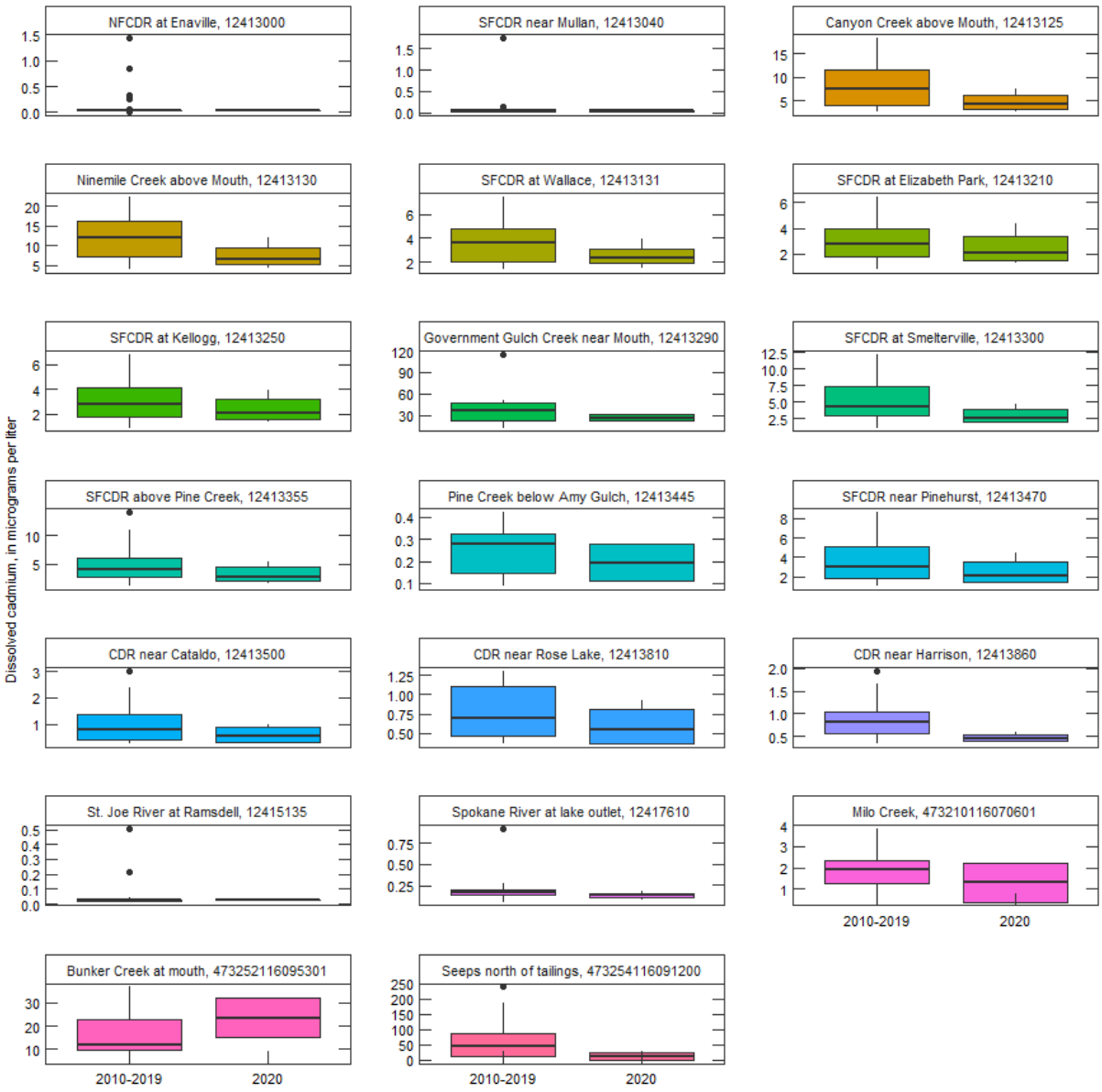

Figure 5. Dissolved cadmium concentrations at BEMP sites in water year 2020 versus 2010-2019. Note the vertical axis scale varies by plot. NF, North Fork; SF, South Fork; CDR, Coeur d'Alene River.

Publication of a Scientific Investigations Report on Long-term Trends in the Spokane River Basin

In September 2020, the USGS published a Scientific Investigations Report (Zinsser, 2020a) and supporting data (Zinsser, 2020b) that included robust statistical analysis of trends in concentrations and loads at twelve BEMP sites, an evaluation of changes in ambient water quality criteria ratios at twenty BEMP sites, and an analysis in changes in contaminant sources in the basin. This report was completed in conjunction with the EPA Five-Year Review. The report is available at https://doi.org/10.3133/sir20205096; supporting data are available at https://doi.org/10.5066/P91LNE8J.

Quality Control Samples

Eight replicate samples and eight equipment blanks were collected in water year 2020. Most analytical results were in good agreement (relative percent difference less than 20%) between replicate pairs. Several samples had somewhat higher (22-29% relative percent differences) between replicate pairs for unfiltered phosphorus, nitrogen, copper and arsenic, and for filtered phosphorus and copper. Higher relative percent differences (up to 107%) between ammonia, orthophosphate, copper and lead results in several replicate pairs were also observed. In the blank samples, most constituents were not detected. However, ammonia and unfiltered iron were detected in one sample each; these analytes were detected at low concentrations near the reporting limit. Unfiltered lead was also detected in two samples at relatively low concentrations (0.12 µg/L and 0.33 µg/L, reporting limit 0.06 µg/L).

After observing high differences in copper concentrations between replicate pairs and several copper detections in blanks in 2019, the USGS tested the deionized water used for sample equipment cleaning in 2020. No analytes were detected in the deionized water. This suggests that another source of contamination, such as filters, may be the source of copper contamination and contribute to high replicate variability. While not currently documented for copper, filter contamination is an issue that is known to impact other constituents (U. S. Geological Survey, 2016). The persistent occurrence of unfiltered lead in equipment blank samples, albeit at low concentrations, suggests that field decontamination procedures for sampling equipment may be insufficient in some cases. The USGS will continue to monitor these issues and review and revise procedures as necessary.

References

Clark, G.M., and Mebane, C.A., 2014, Sources, transport, and trends for selected trace metals and nutrients in the Coeur d'Alene and Spokane River Basins, Idaho, 1990-2013: Reston, VA, 2014-5204. 74 p, at http://pubs.er.usgs.gov/publication/sir20145204.

Clark, G.M., and Perreault, L.M., 2017, Quality Assurance Project Plan (QAPP) for U.S. Geological Survey Surface Water Sampling under the Coeur d'Alene Basin Environmental Monitoring Program at the Bunker Hill Superfund Site - OU2 and OU3.: Prepared for: USEPA, Region 10, p. 51

U. S. Geological Survey, 2016, Office of Water Quality Technical Memorandum 2016.05, Guidance on Annotating Results Affecting by Contamination Bias, with Examples for Water Samples Affected by Co and Mn Contamination from High-Capacity Capsule Filters, p. 9.

U.S. Environmental Protection Agency, 2002, The Bunker Hill Mining and Metallurgical Complex Operable Unit 3, Record of Decision, U.S. Environmental Protection Agency. 527 p, also available at https://nepis.epa.gov.

U.S. Environmental Protection Agency, 2012, Interim Record of Decision (ROD) Amendment, Upper Basin of the Coeur d'Alene River, Bunker Hill Mining and Metallurgical Complex Superfund Site, U.S. Environmental Protection Agency. 488 p, also available at https://semspub.epa.gov/work/10/664107.pdf.

U.S. Geological Survey, 2021, National Water Information System (NWIS): U.S. Geological Survey, at https://nwis.waterdata.usgs.gov/nwis.

Zinsser, L.M., 2020a, Trends in concentration, loads, and sources of trace metals and nutrients in the Spokane River Watershed, northern Idaho, water years 1990–2018: Reston, VA, 2020-5096, at https://doi.org/10.3133/sir20205096.

Zinsser, L.M., 2020b, WRTDS annual concentrations, loads and statistical trend likelihoods for sites in the Spokane River watershed, water years 1990-2018, U. S. Geological Survey, at https://doi.org/10.5066/P91LNE8J.